Programmes After Market Services
TME-3 Series Transceivers

Data Module RL7

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Glossary of Terms

ASIC	Application Specific Integrated Circuit
BB	Baseband
CSP	Chip Scale Package
DB	Dual band
DCS1800	Digital Cellular system at 1800 MHz
DSP	Digital Signal Processor
EMC	Electromagnetic compatibility
EMI	Electromagnetic Interference
FBUS	Asynchronous Full Duplex Serial Bus
GSM	Global System for Mobile communications
HSCSD	High Speed Circuit Switched Data
LNA	Low Noise Amplifier
M2M	System Connector
MBUS	1-wire half duplex serial bus
MCU	Micro Controller Unit
MDI	MCU-DSP Interface
PA	Transmit Power Amplifier
PC	Personal Computer
PWB	Printed Wiring Board
PCM	Pulse Code Modulation
PCM SIO	Synchronous serial bus for PCM audio transferring
RF	Radio Frequency
SIM	Subscriber Identity Module
SMART	PCMCIA interface ASIC

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UEM	Universal Energy Management
UI	User Interface
UPP	Universal Phone Processor
VCXO	Voltage Controlled Crystal Oscillator
VCTCXO	Voltage Controlled Temperature Compensated Crystal Oscillator.

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Functional Description of TME-3

Circuit Description

The Data module baseband blocks provide the MCU, DSP, external memory interface and digital control functions in the UPP ASIC . Power supply circuitry, charging, audio processing and RF control hard ware are in the UEM ASIC.

The purpose of the RF block is to receive and demodulate the radio frequency signal from the base station and to transmit a modulated RF signal to the base station.

GSM Data Module RL7

The description of the RL7 data module is divided into Baseband and RF sections.

Baseband Module

TME-3 baseband supports a power saving function called "sleep mode". As the M2M system protocol link must be active at all time, only so called "light sleep" is activated intermittently. In this mode the MCU has been shut down but peripherals are active.

TME-3 powered externally and does not have battery and thus there is no need for charger functions. The power supply is synchronous step down switching type.

Technical Summary

Main functionality of the baseband is implemented into two ASICs: UPP and UEM.

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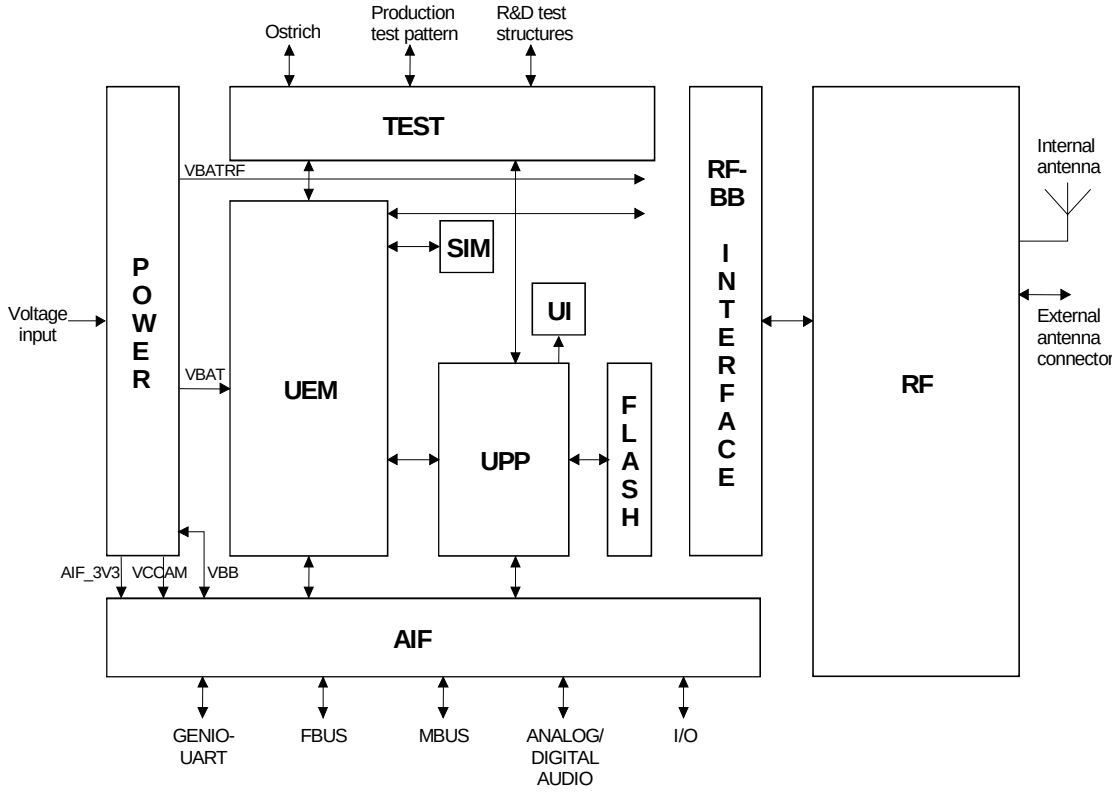
Block Diagram

Figure 1: Block diagram of RL7 module



UPP ASIC provides the MCU, DSP, external memory interface and digital control functions. UEM ASIC contains power supply circuitry, charging, audio processing and RF control hardware.

Technical Summary

Baseband is running from power rails 2.8V analog voltage and 1.8V I/O voltage. UPP core voltage Vcore can be lowered down to 1.0V, 1.3V and 1.5V. UEM includes 6 linear LDO (low drop-out) regulators for baseband and 7 regulators for RF. It also includes 4 current sources for biasing purposes and internal usage. UEM also includes SIM interface which supports 3V SIM cards. TME-3 does not currently support 1.8 V SIMs.

The interface between the baseband and the RF section is handled by a UEM ASIC. The UEM provides A/D and D/A conversion of the in-phase and quadrature receive and transmit signal paths and also A/D and D/A conversions of received and transmitted audio signals to and from the user interface. The UEM supplies the analog TXC and AFC signals to RF section according to the UPP DSP digital control.

Data transmission between the UEM and the UPP is implemented using two serial busses, DBUS for DSP and CBUS for MCU. There are also separate signals for PDM coded audio. Digital speech processing is handled by the DSP inside UPP ASIC. UEM is a dual voltage circuit, the digital parts are running from the baseband supply 1.8V and the analog parts are running from the analog supply 2.78V. UEM uses also VBAT directly

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The baseband supports external microphone inputs and speaker outputs. Input and output signal source selection and gain control is performed by the UEM according to control messages from the UPP. Analog and digital PCM audio are routed to M2M system connector.

EMC shielding for baseband is implemented using metal lids. On the other side the module is shielded with PWB grounding. Heat generated by the circuitry is conducted out via the PWB ground planes.

Modes of Operation

The TME-3 has three modes of operation:

- **RS-232 Mode (M2M system mode)**
- **Application mode (AT command mode)**
- **User Control mode**

Internally the RL7 module has the following operating modes:

- NO_SUPPLY
- POWER_OFF
- POWER_ON
- RESET
- SLEEP
- PROTECTION

RS232 mode

Fig. 2 shows TME-3 in RS-232 mode. TME-3 enters RS-232 mode in powerup when it detects a 68k 1% pull-down resistor at M2M system connector pin 21.

In RS-232 mode TME-3 is connected to DAU-12 RS-232 adapter. The adapter provides a standard RS-232 interface. Power for TME-3 and the adapter is fed through TME-3 DC jack.

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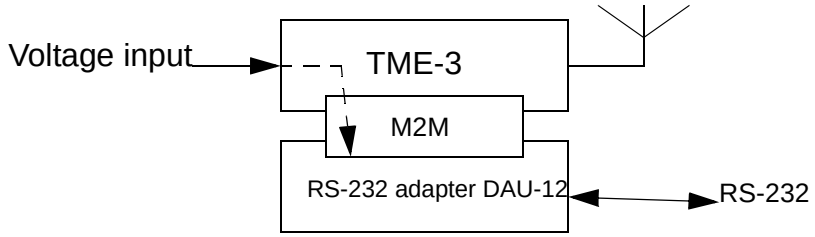
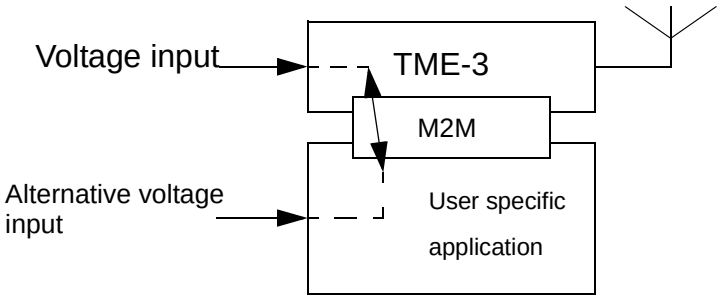
Figure 2: TME-3 RS-232 mode



Application mode

In application mode TME-3 is connected to a user specific application. The mechanical and electrical interface between application and TME-3 is the M2M system connector. The application can be powered through M2M system or the application can deliver power to TME-3.

Figure 3: TME-3 in Application mode



User Control mode

In the user control mode the Nokia 30 GSM Connectivity Terminal is controlled by a mobile phone. Text message templates that are sent from the mobile to the Nokia 30 instruct the terminal, which in turn controls a device or machine attached to it through the M2M System connector.

An example of a device attached to the Nokia 30 for wireless control would be a refrigerator. You might want to check the temperature of the refrigerator when out of town. The temperature of the refrigerator could be altered with the mobile as well.

You could also turn off the lights of the apartment that you had accidentally left on by sending a text message template.

There are three levels of access control for the User control mode.

Firstly, a message identifier entered when the terminal is used for the first time with the Nokia 30 Configurator is only known by the person who entered it. This identifier begins every text message template aimed to control the Nokia 30 and the application attached to it.

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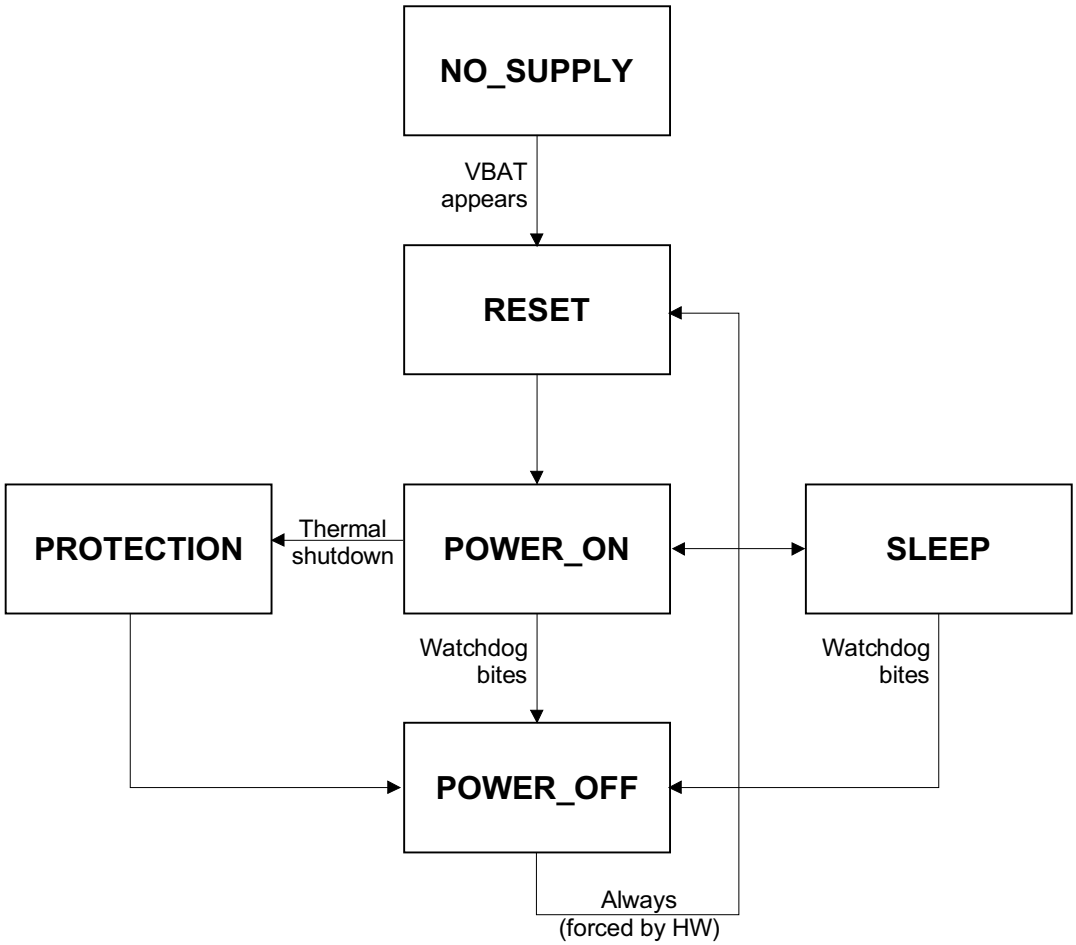
Secondly, it can be specified from which phone number the text message templates are allowed.

Thirdly, a password can be used that is entered whenever a text message template is sent to the Nokia 30.

Internal operation modes

A simplified flow chart of the internal operation modes of TME-3 below.

Figure 4: Internal operation modes



In NO_SUPPLY mode the phone has no supply voltage.

When battery voltage appears, TME-3 enters RESET mode. In TME-3, RESET mode leads always to POWER_ON mode. During low activity TME-3 can switch from POWER_ON to SLEEP mode. PROTECTION mode happens if the thermal shutdown of UEM regulators triggers. PROTECTION mode leads immediately to POWER_OFF mode. TME-3 can enter POWER_OFF mode also from POWER_ON or SLEEP modes if the UEM internal watchdog elapses. POWER_OFF mode is not stationary.

In TME-3 there is a special power-up hardware, which essentially presses automatically the power key as soon as it detects the POWER_OFF mode.

Nominal and maximum ratings

Table 1: s

Parameter	Absolute Maximum Rating
Supply voltage maximum VBB	15 V
DC input voltage (any signal pin *)	-0.5 to 5.5V*
DC output source or sink current (any signal pin)	+/- 10 mA
Operating temperature range	-10...+55 °C
Storage temperature range	-40...+85 °C

DC Characteristics

Table 2: Supply voltage

Pin / Conn.	Line Symbol	Minimum	Typical / Nominal	Maximum	Notes
X100	VBB	6.2 V	12.0 V	14.0 V	Power feed through DC jack
X101/1,3,5,7,9	VBB	4.75 V	12.0 V	15.0 V	Power feed trough M2M system

Table 3: Power consumption

Mode	Current / mA @ 6.7V	Power / W	Notes
POWER_ON, idle	< 10 mA	< 120mW	With one green led on; 65 mW with all leds off.
POWER_ON, full load, 900MHz	< 430 mA	< 5.2 W	Transmitting 2 slots at full power + 300 mA @ 3.6 V power feed to M2M system
POWER_ON, full load, 1800MHz	< 350 mA	< 4.2 W	Transmitting 2 slots at full power + 300 mA @ 3.6 V power feed to M2M system

External signals and connectors

This section describes the external and internal electrical connection and interface levels on the baseband. The electrical interface specifications are collected into tables that covers a connector or a defined interface.

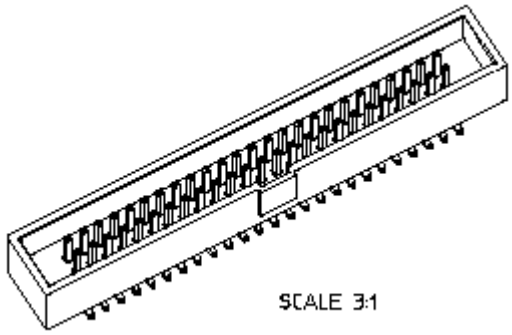
External connectors comprise the following:

M2M system., DC, SIM, external antenna.

M2M system connector

M2M system connector X101 is described below:

Figure 5: M2M system connector X101



The M2M system connector is 50 pin male connector. Connector connects the TME-3 to an external applications, for example to the data-adapter. Connection can be made by female type socket or ribbon cable connector.

Table 4: M2M system connector pinout

Alternate	Name	Pin	Pin	Name	Alternate
	VBB	1	2	GND	
	VBB	3	4	GND	
	VBB	5	6	GND	
	VBB	7	8	GND	
	VBB	9	10	GND	
	VCCAM	11	12	Reset	
	GND	13	14	GENTXD	
	GENRXD	15	16	GND	
	RTSAM	17	18	CTSAM	
	GND	19	20	MBUS	
	Service	21	22	GND	
MIC+	PCMDCLK	23	24	GND	
MIC-	PCMSCLK	25	26	PCMTX	EAR+
	GND	27	28	PCMRX	EAR-
	GND	29	30	FBUSRX	
INPUT1	Reserved	31	32	GND	
INPUT2	DTR	33	34	FBUSTX	
	GND	35	36	RTS	INPUT3
OUTPUT1	Reserved	37	38	GND	
OUTPUT2	DCD	39	40	DSR	OUTPUT3

	GND	41	42	CTS	OUTPUT4
OUTPUT5	RI	43	44	GND	
	Reserved	45	46	Reserved	
	GND	47	48	Reserved	
	Reserved	49	50	GND	

in numbering of the M2M system connection

Odd pins are on the left side of the connector, i.e. 1, 3, 5, 7, etc. Even numbers on the right side of the connector, i.e. 2, 4, 6, 8, etc. Pin 1 is at left top, pin 50 right bottom.

In ribbon cable connection the red stripe conductor of the cable marks pin connection 1. Conductor numbering is then subsequent from 1 to 50 in the cable

DC connector

DC connector X100, described below, is a 3.2 mm DC jack type connector. VIN is connected to the central pin and the jacket is GND.

Table 5: DC connector pin

Signal Name	Pin	Notes
GND	3,4	
VIN	2	6.2 V – 14.0 V power feed

The connector circuitry composes a 2.0 A fuse and transient protection components. Power jack tap is a positive (VIN) and border area is a ground (GND).

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SIM connector

SIM connector X200 interface supports both 1.8V and 3V SIM cards. Note that 5V SIM cards are not supported. The contacts are described below:

Figure 6: SIM connector X200

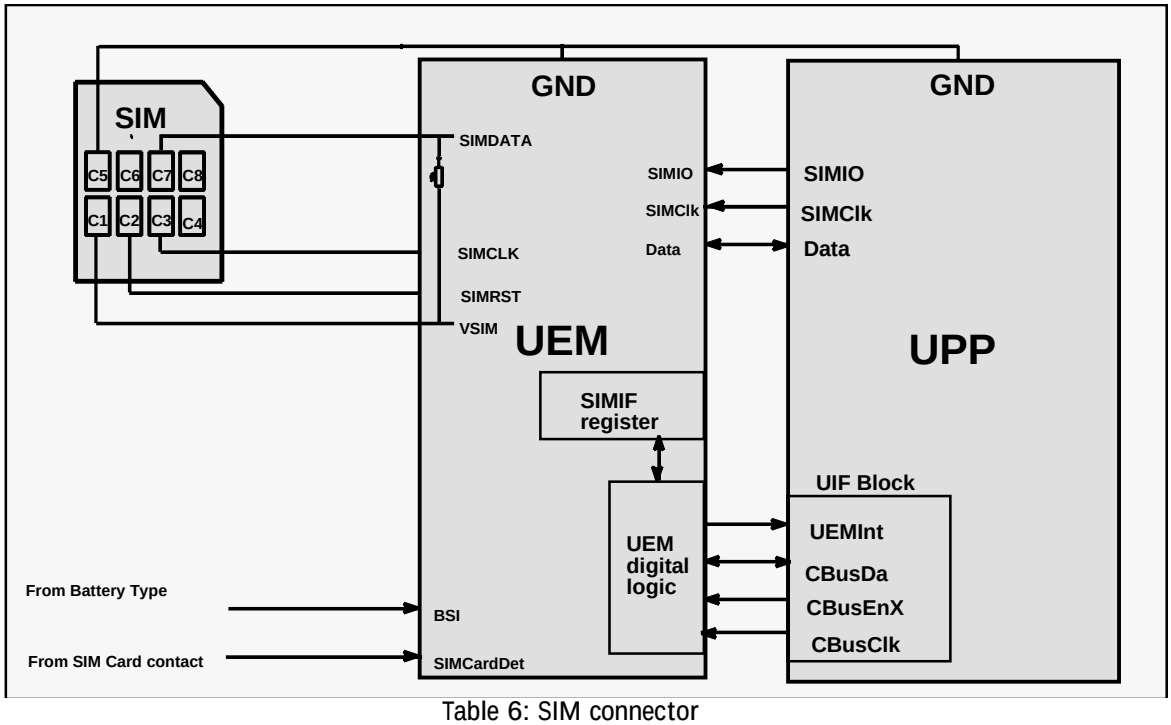


Table 6: SIM connector

Name	Card pin	Description
VSIM	C1	SIM voltage supply 1.8/3.0V
SIMRST	C2	SIM reset
SIMCLK	C3	SIM clock
SIMDATA	C4	SIM bidirectional data
VPP	C5	Unconnected.
GND	C7	

External antenna connector

External antenna connector X502 interface is used to get better RF signal in bad receiving conditions.

Figure 7: External antenna connector X502

Functional Description

POWER

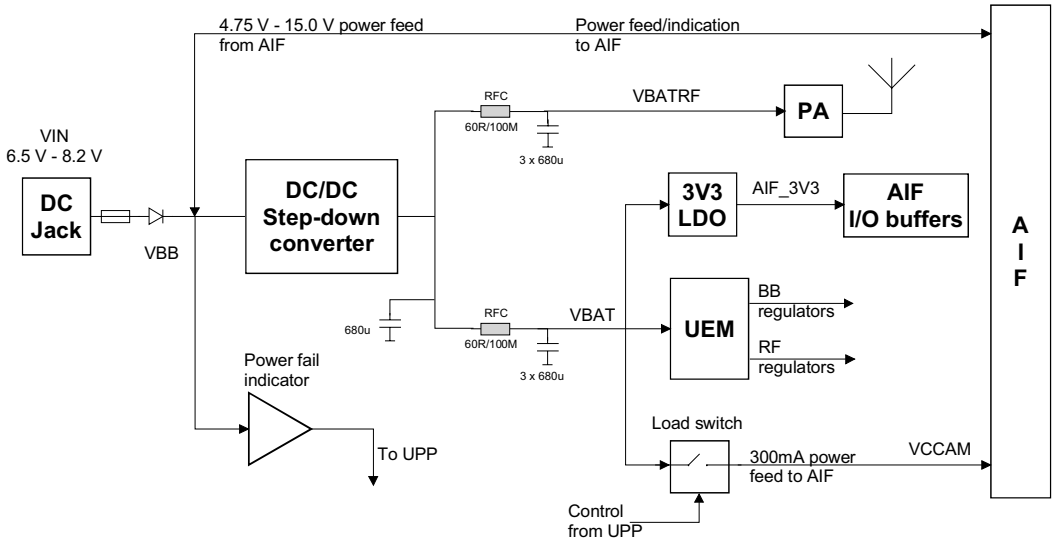
TME-3 operates with external DC wall power supply without a battery. The DC voltage can be supplied either trough the DC jack or the M2M system connector. TME-3 has a wide supply range high efficiency synchronous switched mode step-down converter, which regulates the input voltage down to normal battery voltage level (3.6V).

Power Distribution

Input voltage from DC connector or M2M system (VBB) is fed to step-down DC-DC converter, which regulates the voltage to 3.6V. The 3.6V is fed to DCT4 power management circuit UEM (VBAT), to a 3V3 LDO and to the RF power amplifier (VBATRF). UEM regulates VBAT further for baseband and RF. The 3V3 LDO is used for M2M system I/O buffers. VBAT is fed to M2M system connector through a switch controlled by UPP.

An application can also draw current directly from the fused input voltage (VBB). The available current depends on the input voltage and the power consumption of TME-3. Typical maximum power consumption of TME-3 is less than 5.5 W (including the 300 mA power feed to the application) in all circumstances. For example, if the input voltage is 12.0 V, the application can draw at most 2A - 5.5 W / 12 V = 1540 mA of current without blowing the fuse. However, it is advisable to derate the fuse current to 75% or 1.5 A, which in the example above leaves ~1000 mA current for the application.

Figure 8: TME-3 power distribution.



UEM

UEM is an energy management IC. In addition to energy management functionality the UEM performs all the baseband mixed-signal functions.

User Interface

The TME-3 user interface consist of three two-coloured (green/red) leds.

Six I/O pins from UPP port1, which is normally used for keyboard, are used for led control. Leds are buffered with digital transistors. shows the allocation of led control pins.

Table 7: UI LEDs

BitIO pin #	Function	Description
P10	LED1 – Green	LED Control: 1 = ON, 0 = OFF
P11	LED1 – Red	LED Control: 1 = ON, 0 = OFF
P12	LED2 – Green	LED Control: 1 = ON, 0 = OFF
P13	LED2 – Red	LED Control: 1 = ON, 0 = OFF
P14	LED3 – Green	LED Control: 1 = ON, 0 = OFF
P15	LED3 – Red	LED Control: 1 = ON, 0 = OFF

The leds are connected between VBAT and ground, and there is a current limiting resistor and a transistor switch in series with every led. An 1.8V level active high control signal from UPP KEYB(10:0) switches the leds on and off. The current through a green led is ~15mA, and the current through a red led is ~5mA. This unsymmetry in led drive currents ensures that the brightnesses of leds are equal.

UPP Processor

UPP contains ARM7 and LEAD3 MCU & DSP cores, RAM memory and custom logic.

The UPP block contains also an external flash memory. TME-3 flash size is 32Mbit.

M2M system

The M2M system block contains the M2M system connector and the glue logic needed to make connections between application and the TME-3. The application interface of TME-3 is the standard M2M application interface. The M2M system interface includes FBUS, MBUS, GENIOUSART, analog and digital audios (multiplexed to same pins), DC input voltage, regulated 3.6V battery voltage and some general purpose I/Os.

All signal pins of M2M system are 5V tolerant. The 5V input voltage level is translated down to 2.78V and 1.8V logic levels for UEM and UPP. The outputs of M2M system are translated from UPP/UEM 1.8V and 2.78V levels to 3.3V level.

M2M system connector is a 50-pin male connector.

SIM

The SIM block contains a SIM card reader, which is connected to UEM SIM interface.

Audio

TME-3 does not have any built-in audio equipment, such as microphone or earpiece.

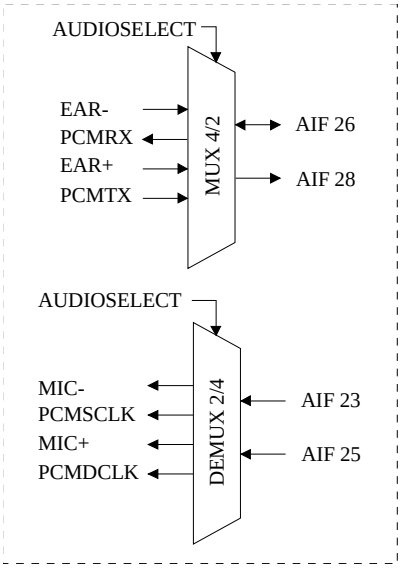
All audio signals are routed outside of TME-3 via M2M system connector to an external audio accessory. The RAE-3 does not include or support vibra and buzzer.

The audio control and processing is done by the UEM, which contains the audio codec. The UPP contains MCU and DSP blocks, handling and processing the audio data signals. The baseband supports one external microphone input and one external earphone output or alternatively digital PCM lines.

Audio Interfaces

TME-3 has two different audio types, digital and analog audios. Those lines are multiplexed in M2M system connector, so there is only one physical audio interface.

Figure 9: Audio control diagram



Audio type selection is made by the audioselect signal from UPP genio pin 28. Audio lines are multiplexed and demuxed by using NC7SB3157 and these components are controlled by the audioselect signal

Earpiece electrical interface

Earpiece circuit includes two ferrite beads, two capacitors (27 pF -> 900 MHz cut-off filter) and two varistors for EMC protection. Earphone lines from the M2M system is connected to the differential output (EARP and EARN) in the UEM audio codec.

Microphone electrical interface

The microphone electrical circuit includes EMI/ESD protections which is placed near the M2M system connector. MICB1 is connected to MIC1P via 1kΩ resistor.

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RF Module

This RF module executes all RF functions of the module. RF circuitry is located on one side (B-side) of the PCB.

EMC leakage is prevented by three metal shields. The first one includes the Bluetooth module. The second block includes the PA, antenna switch, LNAs and dual RX SAW. The last block include the Hagar RF IC, VCO, VCTCXO, baluns and balanced filters.

Maximum height inside on RF-shields is 3 mm. Heat generated by the circuitry will be conducted out via the PWB ground planes.

Heat generated by the circuitry is conducted out via the PWB ground planes.

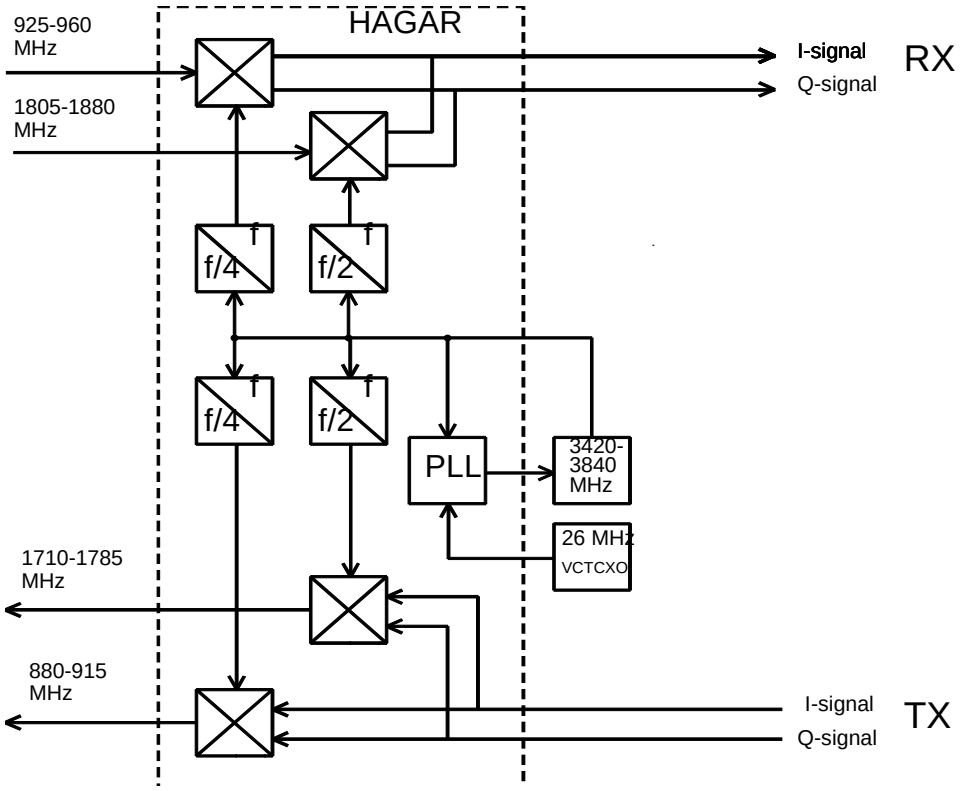
Normal and extreme voltages for RF block

There is no extreme voltage due of the internal power block and no battery use.

Parameter	Rating
Nominal voltage:	3.6 V (generated in PWR block)
Lower extreme voltage	same as nominal
Higher extreme voltage	same as nominal

RF Frequency Plan

Figure 10: RF frequency plan



DC characteristics

Regulators

The transceiver comprises a multifunction power management IC on baseband section, which contains among other functions; 7 pcs of 2.78 V regulators and 4.8V up-switcher for charge pump.

Use of the regulators can be seen in the Power Distribution Diagram. VrefRF01and VrefRF02 are used as the reference voltages for HAGAR RF-IC, VrefRF01 (1.35V) for bias reference and VrfeRF02 (1.35V) for RX ADC's reference.

Regulators (except VR2 and VR7) are connected to HAGAR. Different modes were switched on by the aid of serial bus.

List of the supply voltages:

Volt. source	Load
VR1	PLL charge pump (4,8 V)
VR2	TX modulator
VR3	VCTCXO + buffer
VR4	HAGAR IC (LNAs+mixer+DTOS)
VR5	HAGAR IC (div+LO-buff+prescaler),
VR6	HAGAR (Vdd_bb)
VR7	VCO
VrefRF01	ref. voltage for HAGAR
VrefRF02	ref. voltage for HAGAR
VbattRF	PA

Typical current consumption:

Operation mode	Current consumption	Notes
Power OFF	< 10 uA	Leakage current (dual PA)
RX	81 mA, peak	Includes synthesizer current (28 mA)
TX, without PA	138 mA, peak	
TX, power level 5, EGSM900	1700 mA, peak	
TX, power level 0, DCS1800	1200 mA, peak	

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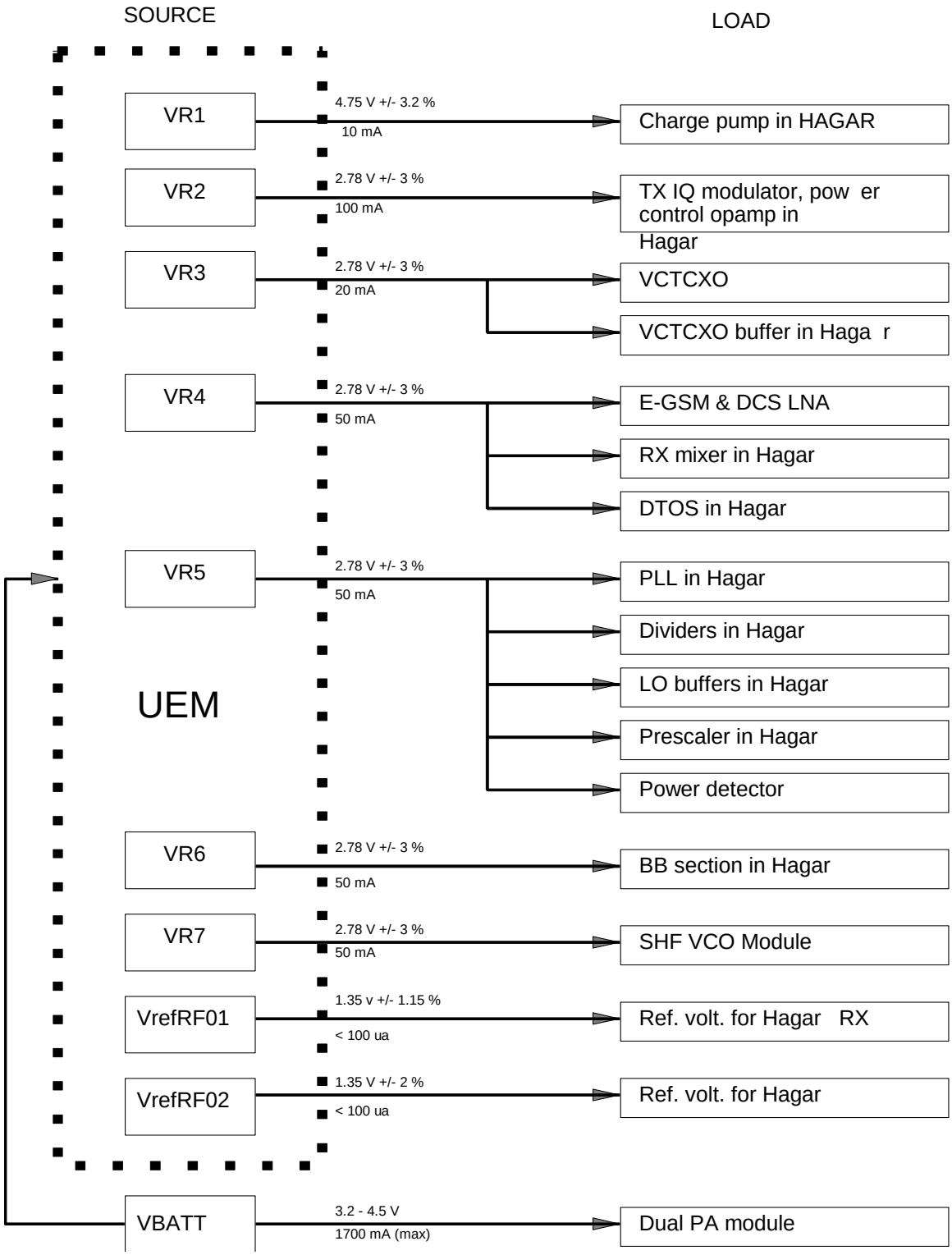
Power Distribution Diagram

Figure 11: Power Distribution



RF characteristics

Main RF characteristics are listed in the table below:

Item	Values (E-GSM / GSM1800)
Receive frequency range	925... 960 MHz / 1805...1880 MHz
Transmit frequency range	880... 915 MHz / 1710...1785 MHz
Duplex spacing	45 MHz / 95 MHz
Channel spacing	200 kHz
Number of RF channels	174 / 374
Power class	4 (2 W) / 1 (1 W)
Number of power levels	15 / 16

Transmitter characteristics

Item	Values (E-GSM/GSM1800)
Type	Direct conversion, nonlinear, FDMA/TDMA
LO frequency range	3520...3660 MHz / 3420...3570 MHz
Output power	2 W / 1 W peak
Gain control range	min. 30 dB
Maximum phase error (RMS/peak)	max 5 deg./20 deg. peak

Receiver characteristics

Item	Values, E-GSM/GSM1800
Type	Direct conversion, Linear, FDMA/TDMA
LO frequencies	3700...3840 MHz / 3610...3760 MHz
Typical 3 dB bandwidth	+/- 91 kHz
Sensitivity	min. - 102 dBm (GSM1800 norm.cond. only)
Total typical receiver voltage gain (from antenna to RX ADC)	86 dB
Receiver output level (RF level -95 dBm)	230 mVpp, single-ended I/Q signals to RX ADCs
Typical AGC dynamic range	83 dB
Accurate AGC control range	60 dB
Usable input dynamic range	-102... -10 dBm
RSSI dynamic range	-110... -48 dBm

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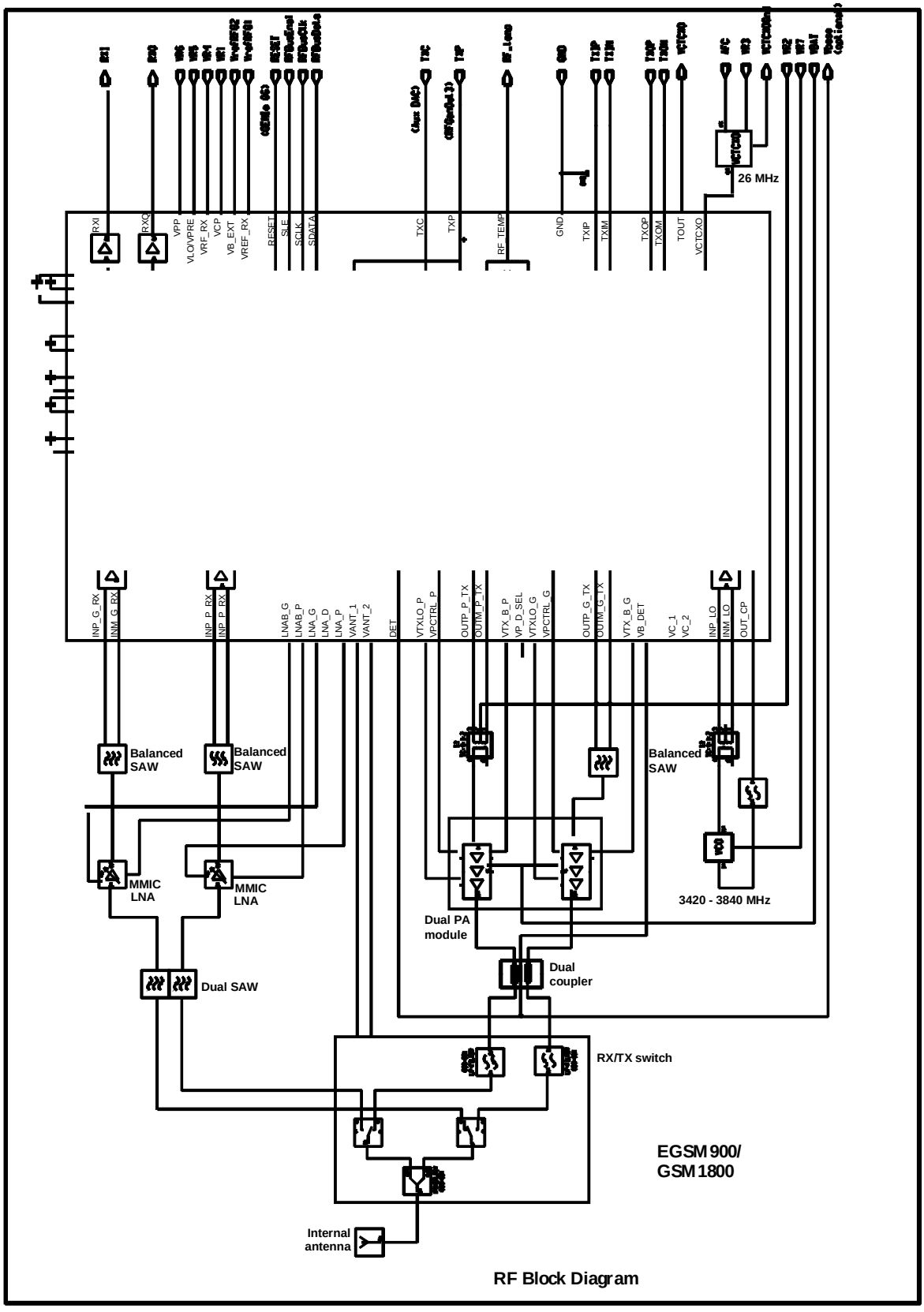
RF Block Diagram



RF Block Diagram

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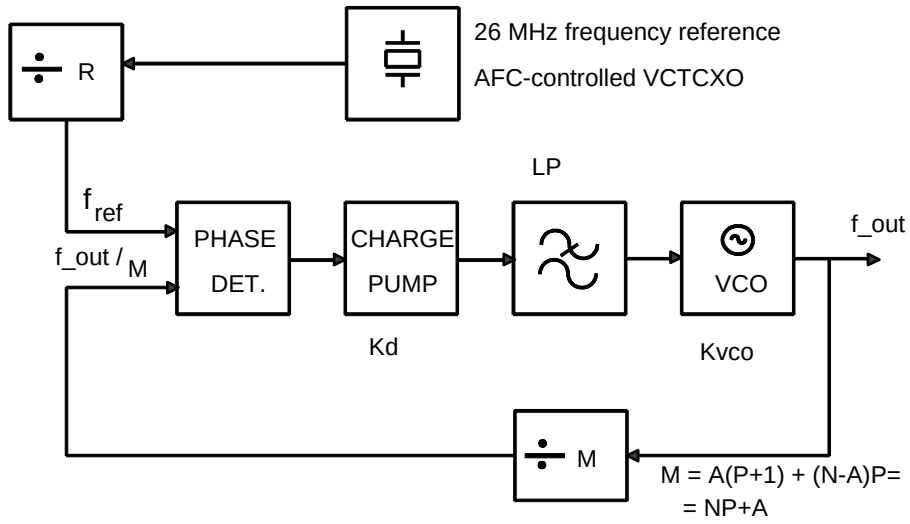
Frequency synthesizers

VCO frequency is locked with PLL into stable frequency source, which is a VCTCXO-module. VCTCXO is running at 26 MHz. Temperature drifting is con trolled with AFC voltage. VCTCXO is locked into frequency of the base station. AFC is generated by baseband with a 11 bit conventional DAC. 13MHz VCTCXO can also be used if multislot operations is not needed.

Figure 12: Phase Locked Loop, PLL



PLL is located in HAGAR RF-IC and is controlled via serial RFBus. There is 64/65 (P/P+1) prescaler, N- and A-divider, reference divider, phase detector and charge pump for the external loop filter. SHF local signal, generated by a VCO-module, is fed through a 180deg balanced phase shifter to prescaler. Output of the prescaler is fed to N- and A-divider, which produces the input to phase detector.

Phase detector compares this signal to reference signal (400kHz), which is divided with reference divider from VCTCXO output. Output of the phase detector is connected into charge pump, which charges or discharges integrator capacitor in the loop filter depending on the phase of the measured frequency compared to reference frequency.

Loop filter filters out comparison pulses of phase detector and generates DC control voltage to VCO.

Dividers are controlled via serial bus. RFBus Data is for data, RFBusClk is serial clock for the bus and RFBusEna1X is a latch enable, which stores new data into dividers.

LO-signal is generated by SHF VCO module. VCO has double frequency in GSM1800 and x 4 frequency in EGSM compared to actual RF channel frequency. LO signal is divided by two or four in HAGAR (depending on system mode).

Receiver

Receiver is a direct conversion, dual band linear receiver. Received RF-signal from the antenna is fed via a RF-antenna switch module to the 1st RX bandpass RF-SAW filters and MMIC LNAs. RF-antenna switch module contains upperband and lowerband opera-

tion. The LNA amplified signal is fed to 2nd RX bandpass RF-SAW filters. Both 2nd RX bandpass RF-SAW filters comprise un-bal/bal configuration to get the balanced (balanced) feed for Hagar.

Discrete LNAs have three gain levels. The first one is max. gain, the second one is about -30dB(GSM1800) and -25dB(EGSM900) below max. gain and the last one is off state. The gain selection control of LNAs comes from HAGAR IC.

Differential RX signal is amplified and mixed directly down to BB frequency in HAGAR. Local signal is generated with external VCO. The VCO signal is divided by 2 (GSM1800) or by 4 (E-GSM900). PLL and dividers are in HAGAR-IC.

From the mixer output to ADC input RX signal is divided into I- and Q-signals. Accurate phasing is generated in LO dividers. After the mixer DTOS amplifiers convert the differential signals to single ended. DTOS has two gain stages. The first one has constant gain of 12dB and 85kHz cut off frequency. The gain of second stage is controlled with control signal g10. If g10 is high (1) the gain is 6dB and if g10 is low (0) the gain of the stage is -4dB.

The active channel filters in HAGAR provides selectivity for channels (-3dB @ +/-91 kHz typ.). Integrated base band filter is active-RC-filter with two off-chip capacitors. Baseband filter consists of two stages, DTOS and BIQUAD. DTOS is differential to single-ended converter having 8dB or 18dB gain. BIQUAD is modified Sallen-Key Biquad.

Integrated resistors and capacitors are tunable. These are controlled with a digital control word. The correct control words that compensate for the process variations of integrated resistors and capacitors and of tolerance of off-chip capacitors are found with the calibration circuit.

Next stage in the receiver chain is a AGC-amplifier, also integrated into HAGAR. AGC has digital gain control via serial mode bus. AGC-stage provides gain control range (40 dB, 10 dB steps) for the receiver and also the necessary DC compensation. Additional 10 dB AGC step is implemented in DTOS stages.

DC compensation is made during DCN1 and DCN2 operations (controlled via serial bus). DCN1 is carried out by charging the large external capacitors in AGC stages to a voltage which cause a zero dc-offset. DCN2 set the signal offset to constant value (VrefRF_02 1.35 V). The VrefRF_02 signal is used as a zero level to RX ADCs.

Single ended filtered I/Q-signal is then fed to ADCs in BB. Input level for ADC is 1.45 Vpp max.

Transmitter

Transmitter chain consists of two final frequency IQ-modulators for upper and lower band, a dual power amplifier and a power control loop.

I- and Q-signals are generated by baseband. After post filtering (RC-net work) they go into IQ-modulator in HAGAR. LO-signal for modulator is generated by VCO and is divided

by 2 or by 4 depending on system mode. There are separate outputs one for EGSM and one for GSM1800.

In EGSM branch there is a SAW filter before PA to attenuate unwanted signals and wide-band noise from the Hagar IC.

The final amplification is realized with dual band power amplifier. It has two different power chains one for EGSM and one for GSM1800. PA is able to produce over 2 W (0 dBm input level) in EGSM band and over 1 W (0 dBm input level) in upperband band into 50 ohm output. Gain control range is over 45 dB to get desired power levels and power ramping up and down.

Any harmonics generated by the PA are filtered out with filtering in side the antenna switch -module.

Power control circuitry consists of discrete power detector (common for lower and upperband) and error amplifier in HAGAR. There is a direction al coupler connected between PA output and antenna switch. It is a dual band type and has input and outputs for both systems. Directional coupler takes a sample from the forward going power with certain ratio. This signal is rectified in a schottky-diode and it produces a DC-signal after filtering.

The possibility to improve efficiency in low power levels has been specified in power amplifier module. The improved efficiency will take place on power level 7 and lower in EGSM. For this option there is control input line in PA module.

AFC function

AFC is used to lock the transceivers clock to frequency of the base station. AFC-voltage is generated in BB with 11 bit DA-converter. There is a RC-filter in AFC control line to reduce the noise from the converter. Settling time requirement for the RC-network comes from signalling, how often PSW (pure sine wave) slots occur. AFC tracks base station frequency continuously, so transceiver has a stable frequency, because changes in VCTCXO-output don't occur so fast (temperature).

Settling time requirement comes also from the start up-time allowed. When transceiver is in sleep mode and "wakes" up to receive mode, there is only about 5 ms for the AFC-voltage to settle. When the first burst comes in system clock has to be settled into +/- 0.1 ppm frequency accuracy. The VCTCXO-module requires also 5 ms to settle into final frequency. Amplitude rises into full swing in 1... 2 ms, but frequency settling time is higher so this oscillator must be powered up early enough.

DC-compensation

DC compensation is made during DCN1 and DCN2 operations (controlled via serial bus). DCN1 is carried out by charging the large external capacitors in AGC stages to a voltage which cause a zero dc-offset. DCN2 set the signal offset to constant value (RXREF 1.35 V). The RXREF signal is used as a zero level to RX ADCs.

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Interfaces and Connectors

Antenna

The TME-3 uses an internal or external dual band antenna.

User Interface Features

The TME-3 does not include a display. All UI functions are performed by Leds located in the A-cover.

*) Application module controllable

Start-up Operation:

Table 8: Start-up Operation:

LED 1	LED 2	Status LED	Description	
-	-	-	Power off / silent mode	
Green scan	Green scan	Green scan	Power on, connecting to network	
-	Red blink	-	PIN query / new PIN query	
-	Red blink	Red blink	PUK query	
			Intensity of Field Strength:	
Red blink	-	-	Non-acceptable	<-105 dBm
Green Blink	-	-		-105 ... -100 dBm
Green	-	-	Weak	-100 ... -95 dBm
Green	Green Blink	-		-95 ... -90 dBm
Green	Green	-	Moderate	-90 ... -85 dBm
Green	Green	Green Blink		-85 ... -80 dBm
Green	Green	Green	Good	>-80 dBm

Normal Operation:

Table 9: Normal Operation:

LED 1	LED 2	Status LED	Description
*	*	Green	In service
*	*	Green blink	Call on
*	*	Green blink	Incoming call
*	*	Green/Red blink	Message received / Voice mail in box
*	*	Red blink	Message arriving and memory is full

*) Application module controllable in M2M System mode

Special Operation:

Table 10: Special Operation:

LED 1	LED 2	Status LED	Description
Green/Red blink	Green/Red blink	Green/Red blink	Insert SIM card
Red blink	Red blink	Red blink	Failure, contact service
Yellow	Yellow	Yellow	Initialising

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Data Module RL7 Parts List

0201802 RL7 RF/Syst Module EDMS Issue: 5.0

Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
A1	9517089	Top	C	7	RF-SHIELD	SHIELD_DMC04003
A3	9517138	Top	H	8	RF-SHIELD	SHIELD_DMC04002
A4	9517137	Bottom	N	5	RF-SHIELD 3	SHIELD_DMC04001
A5	9510791	Top	I	4	RF-SHIELD 2	SHIELD_DMC04000
A3	9510729	Top	H	8	Lid 4	dmd07543
A4	9510728	Bottom	N	5	Lid 3	dmd07542
A5	9519722	Top	I	1	Lid 2	dmd07511
B200	4510219	Top	I	5	32.768KHZ+-30PPM 9PF	CRYSTAL_CX_4V
C100	2320805	Bottom	J	3	Chipcap X5R 100N K 10V 0402	0402C
C101	2320805	Bottom	L	3	Chipcap X5R 100N K 10V 0402	0402C
C102	2320805	Bottom	H	3	Chipcap X5R 100N K 10V 0402	0402C
C103	2320805	Top	E	1	Chipcap X5R 100N K 10V 0402	0402C
C104	2320805	Top	H	1	Chipcap X5R 100N K 10V 0402	0402C
C105	2320805	Top	H	2	Chipcap X5R 100N K 10V 0402	0402C
C107	2610039	Bottom	M	2	CHIPTCAP 68U M 25V 7.3X4.3X4.1	TANT_TPSE
C109	2320783	Top	I	4	Chipcap X7R 33N K 10V 0402	0402C
C110	2320783	Top	I	4	Chipcap X7R 33N K 10V 0402	0402C
C111	2320744	Top	G	2	Chipcap X7R 10% 50V 0402	0402C
C112	2320744	Top	G	1	Chipcap X7R 10% 50V 0402	0402C
C113	2320481	Bottom	L	3	Chipcap X5R 1U K 6V3 0603	0603C
C114	2312243	Bottom	K	2	Chipcap X5R 4U7 K 6V3 0805	0805C
C115	2610043	Bottom	E	4	CHIPTCAP 680U R 4V0 7.3X4.3X3.8	TANTAL_D4
C116	2610043	Bottom	F	4	CHIPTCAP 680U R 4V0 7.3X4.3X3.8	TANTAL_D4
C117	2610043	Bottom	F	5	CHIPTCAP 680U R 4V0 7.3X4.3X3.8	TANTAL_D4
C118	2320546	Bottom	G	3	Chipcap 5% NP0	0402C
C119	2320546	Bottom	H	3	Chipcap 5% NP0	0402C
C120	2320744	Top	O	4	Chipcap X7R 10% 50V 0402	0402C
C121	2320805	Top	M	4	Chipcap X5R 100N K 10V 0402	0402C
C123	2610043	Bottom	M	6	CHIPTCAP 680U R 4V0 7.3X4.3X3.8	TANTAL_D4

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
C124	2610043	Bottom	M	8	CHIPTCAP 680U R 4V0 7.3X4.3X3.8	TANTAL_D4
C126	2360001	Top	O	4	Chipcap X5R 330N K 10V 0603	0603C
C127	2320568	Bottom	N	7	Chipcap 5% X7R	0402C
C128	2320744	Bottom	N	7	Chipcap X7R 10% 50V 0402	0402C
C129	2320744	Top	J	1	Chipcap X7R 10% 50V 0402	0402C
C130	2320744	Top	J	1	Chipcap X7R 10% 50V 0402	0402C
C131	2312243	Top	M	5	Chipcap X5R 4U7 K 6V3 0805	0805C
C133	2320568	Top	M	1	Chipcap 5% X7R	0402C
C134	2320744	Top	M	1	Chipcap X7R 10% 50V 0402	0402C
C135	2320568	Top	J	1	Chipcap 5% X7R	0402C
C136	2320744	Bottom	N	2	Chipcap X7R 10% 50V 0402	0402C
C137	2610039	Bottom	O	2	CHIPTCAP 68U M 25V 7.3X4.3X4.1	TANT_TPSE
C138	2320744	Bottom	M	3	Chipcap X7R 10% 50V 0402	0402C
C139	2320568	Bottom	I	5	Chipcap 5% X7R	0402C
C200	2320481	Top	H	5	Chipcap X5R 1U K 6V3 0603	0603C
C201	2320778	Top	H	5	Chipcap X7R 10% 16V 0402	0402C
C202	2320481	Top	H	5	Chipcap X5R 1U K 6V3 0603	0603C
C203	2320481	Top	G	5	Chipcap X5R 1U K 6V3 0603	0603C
C204	2320481	Top	I	5	Chipcap X5R 1U K 6V3 0603	0603C
C205	2320536	Top	I	5	Chipcap 5% NP0	0402C
C206	2320536	Top	I	4	Chipcap 5% NP0	0402C
C207	2320481	Top	I	3	Chipcap X5R 1U K 6V3 0603	0603C
C208	2320481	Top	G	5	Chipcap X5R 1U K 6V3 0603	0603C
C209	2320805	Bottom	I	5	Chipcap X5R 100N K 10V 0402	0402C
C210	2320481	Bottom	I	5	Chipcap X5R 1U K 6V3 0603	0603C
C211	2320805	Top	I	4	Chipcap X5R 100N K 10V 0402	0402C
C212	2320481	Bottom	H	5	Chipcap X5R 1U K 6V3 0603	0603C
C213	2320805	Bottom	H	4	Chipcap X5R 100N K 10V 0402	0402C
C214	2320481	Top	I	4	Chipcap X5R 1U K 6V3 0603	0603C
C215	2320805	Bottom	E	5	Chipcap X5R 100N K 10V 0402	0402C
C216	2320481	Top	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C217	2320805	Top	G	2	Chipcap X5R 100N K 10V 0402	0402C

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
C218	2320805	Top	H	2	Chipcap X5R 100N K 10V 0402	0402C
C219	2320481	Top	G	5	Chipcap X5R 1U K 6V3 0603	0603C
C220	2320481	Top	G	5	Chipcap X5R 1U K 6V3 0603	0603C
C221	2320805	Top	G	2	Chipcap X5R 100N K 10V 0402	0402C
C222	2320481	Top	F	5	Chipcap X5R 1U K 6V3 0603	0603C
C223	2320805	Top	G	2	Chipcap X5R 100N K 10V 0402	0402C
C224	2320481	Bottom	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C225	2320491	Bottom	G	5	Chipcap X7R 220N K 10V 0603	0603C
C226	2320481	Bottom	H	6	Chipcap X5R 1U K 6V3 0603	0603C
C227	2320481	Top	F	3	Chipcap X5R 1U K 6V3 0603	0603C
C228	2320481	Bottom	G	3	Chipcap X5R 1U K 6V3 0603	0603C
C229	2320481	Bottom	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C230	2320481	Top	F	3	Chipcap X5R 1U K 6V3 0603	0603C
C231	2320481	Bottom	G	3	Chipcap X5R 1U K 6V3 0603	0603C
C232	2320744	Top	I	3	Chipcap X7R 10% 50V 0402	0402C
C233	2320744	Top	I	3	Chipcap X7R 10% 50V 0402	0402C
C234	2320744	Bottom	H	3	Chipcap X7R 10% 50V 0402	0402C
C235	2320744	Top	I	3	Chipcap X7R 10% 50V 0402	0402C
C236	2320481	Bottom	G	4	Chipcap X5R 1U K 6V3 0603	0603C
C237	2320481	Top	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C238	2320481	Bottom	H	4	Chipcap X5R 1U K 6V3 0603	0603C
C239	2320481	Top	F	5	Chipcap X5R 1U K 6V3 0603	0603C
C240	2320481	Top	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C241	2320481	Top	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C242	2320481	Bottom	G	4	Chipcap X5R 1U K 6V3 0603	0603C
C243	2320481	Bottom	G	4	Chipcap X5R 1U K 6V3 0603	0603C
C244	2320481	Top	F	3	Chipcap X5R 1U K 6V3 0603	0603C
C246	2320481	Top	F	4	Chipcap X5R 1U K 6V3 0603	0603C
C247	2320481	Top	H	2	Chipcap X5R 1U K 6V3 0603	0603C
C300	2320805	Top	J	3	Chipcap X5R 100N K 10V 0402	0402C
C301	2320805	Top	J	4	Chipcap X5R 100N K 10V 0402	0402C
C302	2320805	Top	K	5	Chipcap X5R 100N K 10V 0402	0402C

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
C303	2320805	Top	K	5	Chipcap X5R 100N K 10V 0402	0402C
C305	2320805	Top	K	2	Chipcap X5R 100N K 10V 0402	0402C
C320	2320778	Bottom	J	5	Chipcap X7R 10% 16V 0402	0402C
C321	2320778	Bottom	J	4	Chipcap X7R 10% 16V	0402C
C322	2320778	Top	I	5	Chipcap X7R 10% 16V	0402C
C323	2320805	Top	H	2	Chipcap X5R 100N K 10V	0402C
C324	2320779	Bottom	L	6	Chipcap X7R 100N K 16V	0603_BLM
C400	2320560	Top	F	2	Chipcap 5% NP0	0402C
C401	2320560	Top	F	2	Chipcap 5% NP0	0402C
C403	2320560	Top	H	7	Chipcap 5% NP0	0402C
C500	2320548	Top	C	9	Chipcap 5% NP0	0402C
C501	2320546	Top	D	9	Chipcap 5% NP0	0402C
C502	2320526	Top	E	8	Chipcap +-0.25pF NP0	0402C
C503	2320560	Top	E	9	Chipcap 5% NP0	0402C
C504	2320805	Top	E	9	Chipcap X5R 100N K 10V	0402C
C505	2320560	Top	G	9	Chipcap 5% NP0	0402C
C506	2320560	Top	G	9	Chipcap 5% NP0	0402C
C507	2320778	Top	D	9	Chipcap X7R 10% 16V	0402C
C550	2320536	Top	C	8	Chipcap 5% NP0	0402C
C551	2320524	Top	D	8	Chipcap +-0.25pF NP0	0402C
C552	2320516	Top	E	8	Chipcap +-0.25pF NP0	0402C
C553	2320536	Top	E	8	Chipcap 5% NP0	0402C
C554	2320805	Top	E	7	Chipcap X5R 100N K 10V	0402C
C555	2320560	Top	G	8	Chipcap 5% NP0	0402C
C556	2320560	Top	G	8	Chipcap 5% NP0	0402C
C557	2320536	Top	D	8	Chipcap 5% NP0	0402C
C600	2320548	Top	H	7	Chipcap 5% NP0	0402C
C601	2320554	Top	G	8	Chipcap 5% NP0	0402C
C602	2320778	Top	I	7	Chipcap X7R 10% 16V	0402C
C603	2320778	Top	I	8	Chipcap X7R 10% 16V	0402C
C604	2320536	Top	I	7	Chipcap 5% NP0	0402C
C605	2320805	Top	H	9	Chipcap X5R 100N K 10V	0402C

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
C607	2314001	Top	G	9	Chipcap NP0 470P J 6V3	0402C
C608	2320783	Top	I	8	Chipcap X7R 33N K 10V	0402C
C609	2320562	Top	I	8	Chipcap 5% NP0	0402C
C610	2320562	Top	I	8	Chipcap 5% NP0	0402C
C611	2320783	Top	I	8	Chipcap X7R 33N K 10V	0402C
C612	2320778	Top	I	9	Chipcap X7R 10% 16V	0402C
C613	2320805	Top	H	9	Chipcap X5R 100N K 10V	0402C
C614	2320778	Top	I	8	Chipcap X7R 10% 16V	0402C
C615	2320558	Top	H	9	Chipcap 5% NP0	0402C
C616	2320552	Top	I	7	Chipcap 5% NP0	0402C
C617	2320552	Top	I	7	Chipcap 5% NP0	0402C
C620	2320481	Top	I	9	Chipcap X5R 1U K 6V3	0603C
C621	2320481	Top	I	9	Chipcap X5R 1U K 6V3	0603C
C622	2320481	Top	I	9	Chipcap X5R 1U K 6V3	0603C
C623	2320481	Top	H	9	Chipcap X5R 1U K 6V3	0603C
C624	2314001	Top	H	9	Chipcap NP0 470P J 6V3	0402C
C625	2314001	Top	H	9	Chipcap NP0 470P J 6V3	0402C
C626	2314001	Top	H	9	Chipcap NP0 470P J 6V3	0402C
C650	2320554	Top	K	7	Chipcap 5% NP0	0402C
C652	2320564	Top	J	7	Chipcap 5% NP0	0402C
C653	2322015	Top	J	6	Chipcap NP0 2N2 G 16V	0603C
C654	2320564	Top	J	6	Chipcap 5% NP0	0402C
C655	2320481	Top	K	6	Chipcap X5R 1U K 6V3	0603C
C657	2320520	Top	K	7	Chipcap +-0.25pF NP0	0402C
C660	2320560	Top	J	8	Chipcap 5% NP0	0402C
C661	2320779	Top	K	8	Chipcap X7R 100N K 16V	0603_BLM
C662	2320536	Top	K	8	Chipcap 5% NP0	0402C
C699	2320518	Top	F	7	Chipcap +-0.25pF NP0	0402C
C701	2320548	Top	F	6	Chipcap 5% NP0	0402C
C702	2320548	Top	F	7	Chipcap 5% NP0	0402C
C703	2320554	Top	F	7	Chipcap 5% NP0	0402C
C704	2320516	Top	C	4	Chipcap +-0.25pF NP0	0402C

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
C705	2320548	Top	F	7	Chipcap 5% NP0	0402C
C706	2320604	Top	F	7	Chipcap 5% NP0	0402C
C707	2320518	Top	F	8	Chipcap +-0.25pF NP0	0402C
C709	2312243	Top	E	6	Chipcap X5R 4U7 K 6V3	0805C
C710	2320778	Top	B	4	Chipcap X7R 10% 16V 0402	0402C
C711	2320548	Top	D	4	Chipcap 5% NP0	0402C
C712	2320778	Top	D	4	Chipcap X7R 10% 16V 0402	0402C
C713	2320540	Top	E	6	Chipcap 5% NP0	0402C
C714	2320778	Top	D	5	Chipcap X7R 10% 16V 0402	0402C
C715	2320548	Top	B	5	Chipcap 5% NP0	0402C
C716	2320548	Top	C	7	Chipcap 5% NP0	0402C
C717	2320536	Top	C	8	Chipcap 5% NP0	0402C
C718	2320778	Top	C	7	Chipcap X7R 10% 16V	0402C
C719	2320778	Top	C	7	Chipcap X7R 10% 16V	0402C
C720	2320744	Top	B	5	Chipcap X7R 10% 50V	0402C
C721	2320536	Top	G	9	Chipcap 5% NP0	0402C
C722	2320536	Top	G	8	Chipcap 5% NP0	0402C
C723	2320744	Top	G	6	Chipcap X7R 10% 50V	0402C
C724	2320548	Top	B	7	Chipcap 5% NP0	0402C
C726	2320508	Top	G	7	Chipcap +-0.25pF NP0	0402C
C727	2320546	Top	E	5	Chipcap 5% NP0	0402C
C728	2320778	Top	D	5	Chipcap X7R 10% 16V	0402C
C730	2320560	Top	I	7	Chipcap 5% NP0	0402C
C731	2320524	Top	E	7	Chipcap +-0.25pF NP0	0402C
C751	2320560	Top	G	7	Chipcap 5% NP0	0402C
C752	2322023	Top	G	7	Chipcap NP0 2N2 J 16V	0603C
C753	2320538	Top	D	8	Chipcap 5% NP0	0402C
C754	2320538	Top	D	7	Chipcap 5% NP0	0402C
C756	2320546	Top	D	8	Chipcap 5% NP0	0402C
C759	2320546	Top	C	7	Chipcap 5% NP0	0402C
C780	2320548	Top	C	9	Chipcap 5% NP0	0402C
C781	2320548	Top	B	9	Chipcap 5% NP0	0402C

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
D100	4341053	Bottom	I	4	6*BUFFER 1.65V 74LVC07A	TSSOP_14
D101	4341053	Bottom	F	3	6*BUFFER 1.65V 74LVC07A	TSSOP_14
D102	4341307	Bottom	I	3	74LVC244 8XBUFFER	TSSOP_20
D103	4341243	Top	E	1	NC7WZ16 2XBUFFER SC70-6	SC70_6_FAIR
D104	4341307	Bottom	J	3	74LVC244 8XBUFFER	TSSOP_20
D105	4341245	Top	G	1	1XMUX/DEMUX 2:1 NC7SB3157	SC70_6_FAIR
D106	4341245	Top	G	1	1XMUX/DEMUX 2:1 NC7SB3157	SC70_6_FAIR
D107	4341245	Bottom	H	2	1XMUX/DEMUX 2:1 NC7SB3157	SC70_6_FAIR
D108	4341245	Bottom	G	2	1XMUX/DEMUX 2:1 NC7SB3157	SC70_6_FAIR
D200	4370825	Top	H	4	UEMK W-DOG ENA TO21	TFBGA168
D300	4370873	Top	K	4	UPP8M V2.6 F751986E C035	uBGA144
D320	4340831	Bottom	K	4	FLASH 2MX16 1,8V	FBGA40
F100	5119002	Top	M	2	Fuse 2A 32V SMD	1206_FUSE
F101	5119002	Top	K	1	Fuse 2A 32V SMD	1206_FUSE
G650	4350243	Top	J	7	VCO 3420-3840MHZ 2.7V 20MA	VCO_GK_601MNA_2
G660	4510261	Top	J	9	VCTCXO 26MHZ+-5PPM 2.7V GSM	VCTCXO_KT16
L100	3203743	Bottom	N	1	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L101	3203743	Bottom	M	5	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L102	3203715	Bottom	H	2	FERRITE BEAD 0R35 240R/100M	FERRITE_BK1005
L103	3203715	Bottom	G	2	FERRITE BEAD 0R35 240R/100M	FERRITE_BK1005
L104	3203743	Bottom	N	7	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L105	3640109	Bottom	N	5	CHIP COIL 15U M 2.0A 12.95X9.4X3	COIL_DO3308
L106	3203743	Top	N	1	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L107	3203743	Top	M	1	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L108	3203743	Top	J	1	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L109	3203743	Top	J	1	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L110	3640475	Bottom	O	3	CHOKE 10U M 0R16 1.1A 6.6X4.45	DT1608
L200	3203741	Top	F	5	FERRITE BEAD 0R5 600R/100MHZ	0603_BLM
L201	3203741	Top	H	5	FERRITE BEAD 0R5 600R/100MHZ	0603_BLM
L202	3203741	Top	G	5	FERRITE BEAD 0R5 600R/100MHZ 0	0603_BLM
L203	3203741	Top	F	5	FERRITE BEAD 0R5 600R/100MHZ 0	0603_BLM
L204	3203741	Top	F	4	FERRITE BEAD 0R5 600R/100MHZ	0603_BLM

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
L205	3203741	Top	I	2	FERRITE BEAD 0R5 600R/100MHZ	0603_BLM
L500	3646091	Top	E	9	CHIP COIL 6N8 J Q27/800M 0402	0402L
L501	3646067	Top	G	9	CHIP COIL 18N J Q29/800M 0402	0402L
L502	3646091	Top	D	9	CHIP COIL 6N8 J Q27/800M 0402	0402L
L503	3646065	Top	D	9	CHIP COIL 12N J Q31/800M 0402	0402L
L550	3646053	Top	E	8	CHIP COIL 4N7 +-0N3 Q28/800M	0402L
L551	3646091	Top	G	8	CHIP COIL 6N8 J Q27/800M 0402	0402L
L552	3646047	Top	D	8	CHIP COIL 3N3 +-0N3 Q28/800M	0402L
L700	3646053	Top	G	7	CHIP COIL 4N7 +-0N3 Q28/800M	0402L
L701	3646053	Top	G	6	CHIP COIL 4N7 +-0N3 Q28/800M	0402L
L702	3646051	Top	G	7	CHIP COIL 3N9 +-0N3 Q28/800M	0402L
L703	3203743	Top	E	5	FERR.BEAD 0R03 42R/100MHZ 3A	0805_BLM21
L704	3203715	Top	B	4	FERRITE BEAD 0R35 240R/100M	FERRITE_BK1005
L705	3646059	Top	B	4	CHIP COIL 5N6 +-0N3 Q28/800M	0402L
L708	3645065	Top	B	6	CHIP COIL 5N6 K Q98/1.5GHZ 0805	0805HQ
L750	4551015	Top	C	7	DIR.COUP 897.5/1747.5/1880MHZ	COUPLER_LDC15D
N100	4340663	Bottom	L	2	LP2985 REG 3.3V 150A SOT23-5	SOT23_5_H1.45
N101	4341217	Top	N	4	DC/DC CONTROL (MAX1653)	QSOP16_H1.73
N102	4341215	Bottom	J	5	1XCOMP VREF=1.245 MAX918	SOT23_5_H1.45
N600	4370781	Top	H	8	HAGAR 5 LFBGA80	uBGA80_H1.7
N700	4350297	Top	C	6	PW AMP RF9203E10.1 900/1800 3.5V	E5_H1.65
R100	1430770	Bottom	H	4	Resistor 5% 63mW	0402R
R101	1430770	Bottom	H	4	Resistor 5% 63mW	0402R
R102	1430770	Bottom	H	4	Resistor 5% 63mW	0402R
R103	1430770	Bottom	I	5	Resistor 5% 63mW	0402R
R104	1430770	Bottom	J	4	Resistor 5% 63mW	0402R
R105	1430770	Bottom	J	4	Resistor 5% 63mW	0402R
R106	1430770	Bottom	G	3	Resistor 5% 63mW	0402R
R107	1430770	Bottom	G	3	Resistor 5% 63mW	0402R
R108	1430770	Bottom	E	2	Resistor 5% 63mW	0402R
R109	1430770	Bottom	G	2	Resistor 5% 63mW	0402R

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
R110	1430726	Bottom	A	4	Resistor 5% 63mW	0402R
R111	1430740	Bottom	A	4	Resistor 5% 63mW	0402R
R112	1430726	Bottom	C	4	Resistor 5% 63mW	0402R
R113	1430740	Bottom	C	4	Resistor 5% 63mW	0402R
R114	1430726	Bottom	B	4	Resistor 5% 63mW	0402R
R115	1430740	Bottom	B	4	Resistor 5% 63mW	0402R
R116	1430754	Bottom	E	3	Resistor 5% 63mW	0402R
R117	1430770	Bottom	J	5	Resistor 5% 63mW	0402R
R118	1430873	Bottom	I	5	CHIPRES 0W06 27K F 0402	0402R
R119	1430907	Bottom	I	5	CHIPRES 0W06 11K F 0402	0402R
R125	1430762	Top	G	2	Resistor 5% 63mW	0402R
R129	1430762	Top	G	1	Resistor 5% 63mW	0402R
R131	1430714	Bottom	G	3	Resistor 5% 63mW	0402R
R132	1430714	Bottom	G	3	Resistor 5% 63mW	0402R
R134	1414655	Bottom	N	7	CHIPRES 0W125 0R10 J 0805	0805R
R135	1430796	Bottom	E	2	Resistor 5% 63mW	0402R
R137	1414655	Bottom	O	7	CHIPRES 0W125 0R10 J 0805	0805R
R141	1430804	Top	K	2	Resistor 5% 63mW	0402R
R142	1430796	Top	K	2	Resistor 5% 63mW	0402R
R143	1430770	Top	J	1	Resistor 5% 63mW	0402R
R144	1430121	Top	N	5	Chipres 0W06 22k F 200ppm 0402	0402R
R145	1430187	Top	N	5	Chipres 0W06 47k F 200ppm 0402	0402R
R146	1825005	Bottom	N	1	CHIP VARISTOR VWM14V VC30V	0805_VARISTOR_SIOV
R147	1825033	Bottom	H	2	CHIP VARISTOR VW14V VC46V 0402	0402_VAR
R148	1825033	Bottom	G	2	CHIP VARISTOR VW14V VC46V 0402	0402_VAR
R149	1430778	Top	E	2	Resistor 5% 63mW	0402R
R150	1430796	Top	O	5	Resistor 5% 63mW	0402R
R151	1430690	Top	J	2	Chipres 0W06 jumper 0402	0402R
R153	1430770	Top	I	3	Resistor 5% 63mW	0402R
R154	1430796	Top	I	3	Resistor 5% 63mW	0402R
R155	1430770	Bottom	K	3	Resistor 5% 63mW	0402R
R156	1430911	Top	I	2	Resistor 1% 63mW	0402R

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
R157	1430911	Top	I	2	Resistor 1% 63mW	0402R
R158	1430911	Top	J	3	Resistor 1% 63mW	0402R
R159	1430911	Top	I	2	Resistor 1% 63mW	0402R
R160	1430911	Top	I	3	Resistor 1% 63mW	0402R
R161	1430911	Top	I	3	Resistor 1% 63mW	0402R
R162	1430726	Bottom	H	2	Resistor 5% 63mW	0402R
R163	1430726	Bottom	G	2	Resistor 5% 63mW	0402R
R164	1430690	Top	O	4	Chipres 0W06 jumper 0402	0402R
R202	1620067	Top	I	3	RES NETWORK 0W06 4X100K J	MNR0804
R204	1430215	Top	J	3	CHIPRES 0W06 68K F 200PPM	0402R
R205	1430790	Bottom	G	3	Resistor 5% 63mW	0402R
R206	4120071	Bottom	A	6	ASIP EMIF03-SIM01 SIM FILTER	uBGA8
R207	1430778	Bottom	H	6	Resistor 5% 63mW	0402R
R320	1430770	Bottom	L	6	Resistor 5% 63mW	0402R
R400	1430778	Top	F	2	Resistor 5% 63mW	0402R
R401	1430778	Top	F	2	Resistor 5% 63mW	0402R
R403	1430726	Top	H	7	Resistor 5% 63mW	0402R
R500	1430726	Top	E	9	Resistor 5% 63mW	0402R
R501	1430700	Top	E	9	Resistor 5% 63mW	0402R
R502	1430832	Top	D	9	Resistor 5% 63mW	0402R
R520	1430830	Bottom	D	2	Resistor 5% 63mW	0402R
R551	1430700	Top	E	7	Resistor 5% 63mW	0402R
R558	1430832	Top	D	8	Resistor 5% 63mW	0402R
R600	1620081	Top	I	9	RES NETWORK 0W03 4X22R J 0804	MNR04
R602	1430770	Top	I	9	Resistor 5% 63mW	0402R
R603	1430846	Top	G	8	Resistor 1% 63mW	0402R
R604	1430770	Top	H	9	Resistor 5% 63mW	0402R
R606	1430784	Top	H	9	Resistor 5% 63mW	0402R
R607	1620033	Top	I	7	RES NETWORK 0W06 2X5K6 J 0404	0404_R
R608	1620033	Top	I	7	RES NETWORK 0W06 2X5K6 J 0404	0404_R
R610	1430700	Top	I	7	Resistor 5% 63mW	0402R
R650	1430137	Top	J	6	CHIPRES 0W06 1K0 F 200PPM 0402	0402R

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
R651	1430907	Top	J	6	CHIPRES 0W06 11K F 0402	0402R
R652	1430700	Top	K	7	Resistor 5% 63mW	0402R
R660	1430762	Top	J	8	Resistor 5% 63mW	0402R
R661	1430774	Top	K	8	Resistor 5% 63mW	0402R
R700	1620121	Top	G	7	RES NETWORK 0W06 2X220R J	MNR02_SR 0404
R701	1620121	Top	F	7	RES NETWORK 0W06 2X220R J	MNR02_SR 0404
R703	1430714	Top	D	7	Resistor 5% 63mW	0402R
R704	1430718	Top	C	7	Resistor 5% 63mW	0402R
R705	1620515	Top	C	4	RES NETWORK 0W04 1DB ATT	0404_RAC10
R706	1430693	Top	G	6	Chipres 0W06 5R6 J 0402	0402R
R707	1430693	Top	G	7	Chipres 0W06 5R6 J 0402	0402R
R709	1430734	Top	B	7	Resistor 5% 63mW	0402R
R751	1430770	Top	D	7	Resistor 5% 63mW	0402R
R752	1430788	Top	H	7	Resistor 5% 63mW	0402R
R753	1430770	Top	D	8	Resistor 5% 63mW	0402R
R754	1430726	Top	D	7	Resistor 5% 63mW	0402R
R755	1430718	Top	C	8	Resistor 5% 63mW	0402R
R756	1430770	Top	H	6	Resistor 5% 63mW	0402R
R757	1430778	Top	D	7	Resistor 5% 63mW	0402R
R780	1430700	Top	B	9	Resistor 5% 63mW	0402R
R781	1430700	Top	B	9	Resistor 5% 63mW	0402R
T650	3640423	Top	I	8	BALUN TRANS 3.7GHZ+/-300MHZ	TRANS_LDB15 0805
T700	4550137	Top	F	7	TRANSF BALUN 1.8GHZ+-100MHZ	TRANS_LDB15 2x1.3
V100	4864511	Top	A	7	LED MUW GRN/RED 570/620NM	LED_SML_521
V101	4864511	Top	A	5	LED MUW GRN/RED 570/620NM	LED_SML_521
V102	4864511	Top	A	4	LED MUW GRN/RED 570/620NM	LED_SML_521
V103	4210043	Bottom	B	4	TR DTC143ZE RB=4K7 RBE=47K	EM3
V104	4210043	Bottom	C	4	TR DTC143ZE RB=4K7 RBE=47K	EM3
V105	4210043	Bottom	C	4	TR DTC143ZE RB=4K7 RBE=47K	EM3
V106	4210043	Bottom	A	4	TR DTC143ZE RB=4K7 RBE=47K	EM3
V107	4210043	Bottom	B	4	TR DTC143ZE RB=4K7 RBE=47K	EM3
V108	4210043	Bottom	A	4	TR DTC143ZE RB=4K7 RBE=47K	EM3

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Table 11: Parts list RL7_11

Item	Code	Side	Coordinates		Part data	Part name, type
V109	4110074	Bottom	O	1	SCH DI 40V 3A	SOD6
V110	4110078	Top	M	4	SLHDIx2 70mA	SOT323
V111	4211321	Bottom	M	3	MFET FDS6912A N 30V 6A 0R035	SO8N2
V112	4211391	Top	K	1	MFET P FDC6323L SWITCH 3-8V	TSOP_6
V114	4110074	Bottom	M	5	SCH DI 40V 3A	SOD6
V115	4110078	Top	E	2	SLHDIx2 70mA	SOT323
V120	4110078	Bottom	K	3	SLHDIx2 70mA	SOT323
V200	4219926	Bottom	I	5	TR+RX2 RN1302 N 50V 50MA 10K	SOT323
V201	4219926	Bottom	H	5	TR+RX2 RN1302 N 50V 50MA 10K	SOT323
V500	4210277	Top	D	9	TR BGB420 MIRROR ADJ BIAS	SOT343_R
V550	4210261	Top	D	8	TR BGA428 LNA1.8GHZ 19.5DB	SOT_363
V750	4110079	Top	D	7	SCH DIX2 HSMS282C 15V <1PF	SOT323
X100	5409003	Top	N	2	SMD JACK 3.0MM F DC 9V 1A	SMK_JACK_SWITCH
X101	5400225	Bottom	H	1	SM PIN HEADER 2X25M P1.27MM STR	SAMTEC_ASP_67923_02
X200	5409201	Bottom	C	6	SM SIM CONN 2X3POL	SK51002_001
X502	5429017	Bottom	C	3	SM CONN RF PLUG+SW 3GHZ 1W 90DEG	SWITCH_SHALTER
Z100	4120051	Top	I	1	EMI ESD FILT10CH IP4026CX25	uBGA_25_P0.75
Z101	4120051	Top	F	1	EMI ESD FILT10CH IP4026CX25	uBGA_25_P0.75
Z500	4512133	Top	B	8	ANT.SWIT.880-960/1710-1990MHZ	7x5 UM_0318C1
Z501	4511235	Top	F	9	SAW FILT 942.5+-17.5MHZ/3.8DB	3x3 DCC6D_H1.15
Z520	4511181	Top	D	9	Filter SAW 925-960/1805-1880 MHZ	QCC8B_4.0X4.0
Z551	4511241	Top	F	8	SAW FILT 1842.5+-37.5MHZ/3.5DB	3x3 DCC6D_H1.15
Z700	4511237	Top	F	7	SAW FILT 897.5+-17.5MHZ/4.2DB	3x3 DCC6D_H1.15

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